

AMENDED CLAIM SET

The claims have been amended as set forth in the following listing of the claims:

1. (Currently Amended) An exhaust purification device for internal combustion engine, comprising:

a catalytic converter provided in an exhaust passage of an internal combustion engine;
~~combustion engine~~;

an air/fuel ratio forcibly modulating element for forcibly modulating the air/fuel ratio of exhaust flowing into the catalytic converter, between a lean air/fuel ratio leaner than a target average air/fuel ratio and a rich air/fuel ratio richer than the target average air/fuel ratio, with a specific period, a specific amplitude, a specific modulation ratio and a specific waveform;
~~specific waveform~~;

an oxygen sensor provided in the exhaust passage for detecting the oxygen concentration of the exhaust and supplying an output corresponding to the detected oxygen concentration;
~~oxygen concentration~~;

a time ratio calculating element for obtaining one of the
_____ a ratio of a time for which the output of the oxygen sensor is greater than a standard value for the output set between the maximum and minimum values of the output, ~~or~~
_____ a ratio of a time for which the output of the oxygen sensor is smaller than the standard value for the output, in a predetermined period of time, and ~~or~~
_____ a value correlating with the ratio; and ~~the ratio~~, ~~and~~

an air/fuel ratio adjusting element for adjusting the air/fuel ratio of the exhaust during the forcible modulation, such that an actual average air/fuel ratio, obtained on the basis of one of the ratio and the ratio or the value correlating with the ratio obtained by the time ratio calculating element, matches the target average air/fuel ratio, wherein

the period of the modulation is set to be one of equal and shorter ~~equal to or shorter than~~ a maximum period which ensures the air/fuel ratio to be detected on the basis of the output of the oxygen sensor does not reach one of the upper and lower limits ~~the upper or lower limit~~ of a range of air/fuel ratios detectable by the oxygen sensor.

2. (Original) The exhaust purification device for internal combustion engine according to claim 1, wherein

the predetermined period of time is an integer times the period of the modulation.

3. (Canceled)

4. (Original) The exhaust purification device for internal combustion engine according to claim 1, wherein

the air/fuel ratio forcibly modulating element performs the forcible modulation so that the output of the oxygen sensor varies passing through a switch point of an output characteristic curve of the oxygen sensor.

5. (Currently Amended) The exhaust purification device for internal combustion engine according to claim 4, wherein

the standard value for the output is set to one of an output value at the switch point and in ~~the or in the~~ vicinity of the switch point.

6. (Original) The exhaust purification device for internal combustion engine according to claim 1, wherein

the oxygen sensor has a catalytic function.

7. (Currently Amended) The exhaust purification device for internal combustion engine according to claim 1, wherein

the air/fuel ratio adjusting element adjusts the air/fuel ratio of the exhaust during the forcible modulation, on the basis of one of a difference between the ratio and the ~~or the~~ value correlating with the ratio obtained by the time ratio calculating element and a standard value for the ratio.

8. (Original) The exhaust purification device for internal combustion engine according to claim 1, wherein

the value correlating with the ratio is obtained, when the ratio is greater than the standard value for the ratio, by correcting the ratio in a manner such that the ratio is more increased when the period of the modulation is longer and more decreased when the period of the modulation is shorter, and when the ratio is smaller than the standard value for the ratio, by correcting the ratio

in a manner such that the ratio is more decreased when the period of the modulation is longer and more increased when the period of the modulation is shorter.

9. (Original) The exhaust purification device for internal combustion engine according to claim 1, wherein

the value correlating with the ratio is obtained, when the ratio is greater than the standard value for the ratio, by correcting the ratio in a manner such that the ratio is more increased when the amplitude of the modulation is greater and more decreased when the amplitude of the modulation is smaller, and when the ratio is smaller than the standard value for the ratio, by correcting the ratio in a manner such that the ratio is more decreased when the amplitude of the modulation is greater and more increased when the amplitude of the modulation is smaller.

10. (Original) The exhaust purification device for internal combustion engine according to claim 1, wherein

the value correlating with the ratio is obtained, when the ratio is greater than the standard value for the ratio, by correcting the ratio in a manner such that the ratio is more increased when the waveform of the modulation is closer to a square wave and more decreased when the waveform of the modulation is further from the square wave, and when the ratio is smaller than the standard value for the ratio, by correcting the ratio in a manner such that the ratio is more decreased when the waveform of the modulation is closer to the square wave and more increased when the waveform of the modulation is further from the square wave.

11. (Currently Amended) The exhaust purification device for internal combustion engine according to claim 1, further comprising:~~further comprising~~

a rotational speed detecting element for detecting the rotational speed of the internal combustion engine, wherein

the value correlating with the ratio is obtained, when the ratio is greater than the standard value for the ratio, by correcting the ratio in a manner such that the ratio is more increased when the rotational speed of the internal combustion engine detected by the rotational speed detecting element is higher and more decreased when the rotational speed is lower, and when the ratio is smaller than the standard value for the ratio, by correcting the ratio in a manner such that the ratio is more decreased when the rotational speed is higher and more increased when the rotational speed is lower.

12. (Currently Amended) The exhaust purification device for internal combustion engine according to claim 1, further comprising:~~further comprising~~

an exhaust flow rate detecting element for detecting the flow rate of the exhaust, wherein

the value correlating with the ratio is obtained, when the ratio is greater than the standard value for the ratio, by correcting the ratio in a manner such that the ratio is more increased when the flow rate of the exhaust detected by the exhaust flow rate detecting element is greater and more decreased when the flow rate of the exhaust is smaller, and when the ratio is smaller than the standard value for the ratio, by correcting the ratio in a manner such that the ratio is more decreased when the flow rate of the exhaust is greater and more increased when the flow rate of the exhaust is smaller.

13. (Currently Amended) The exhaust purification device for internal combustion according to claim 1, wherein

one of the standard value for the ratio of the time for which the output of the oxygen sensor is greater than the standard value for the output, and for ~~or for~~ the value correlating with the ratio is in the range of 0.5 to 0.75.

14. (Currently Amended) The exhaust purification device for internal combustion according to claim 1, wherein

the standard value for the ratio of the time for which the output of the oxygen sensor is smaller than the standard value for one of the output and the output, ~~or for~~ the value correlating with the ratio is in the range of 0.25 to 0.5.

15. (Currently Amended) The exhaust purification device for internal combustion according to claim 1, wherein

the air/fuel ratio forcibly modulating element includes a change element for making change according to the operating states of the internal combustion engine, and

the time ratio calculating element stores changed periods of the modulation in the past, and obtains the value correlating with the ratio, from one of the time for which the output of the oxygen sensor is greater than the standard value for the output and the ~~or the~~ time for which the output of the oxygen sensor is smaller than the standard value for the output, obtained this time, and a past changed period of the modulation stored.

16. (Currently Amended) The exhaust purification device for internal combustion according to claim 1, wherein

the air/fuel ratio forcibly modulating element includes a change element for making change according to the operating states of the internal combustion engine, and

the time ratio calculating element stores one of the time for which the output of the oxygen sensor was greater than the standard value for the output and the ~~or the~~ time for which the output of the oxygen sensor was smaller than the standard value for the output, obtained last time, and obtains the value correlating with the ratio, from one of the time for which the output of the oxygen sensor is greater than the standard value for the output, obtained this time, and the sum of the time for which the output of the oxygen sensor is greater than the standard value for the output, obtained this time, and the time for which the output of the oxygen sensor was smaller than the standard value for the output, obtained last time, and ~~or from~~ the time for which the output of the oxygen sensor is smaller than the standard value for the output, obtained this time, and the sum of the time for which the output of the oxygen sensor is smaller than the standard value for the output, obtained this time, and the time for which the output of the oxygen sensor was greater than the standard value for the output, obtained last time.

17. (New) The exhaust purification device for internal combustion according to claim 1, wherein the average A/F is determined from a map.